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BRYOPHYTES OF ALGIFIC TALUS SLOPES IN WISCONSIN'S DRIFTLESS AREA

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ABSTRACT

Naturally refrigerated (algific) talus slopes provide microclimates suitable for disjunct or relict populations of plants and invertebrates. Of 39 species of bryophytes collected on four of Wisconsin's largest algific slopes, one-third were restricted to cold air vents. Distribution of species on these slopes appears to be influenced by perennially stable air temperatures and condensate occurring at outflow vents. The moss *Seligeria donniana* is new to Wisconsin.

Key Words: bryophytes, algific talus slopes, cold air drainage, Driftless Area, Wisconsin

INTRODUCTION

Algific talus slopes are characterized by the venting of frigid air through openings among talus debris, and the associated refrigeration of rocks and shallow soils on these slopes. The temperature of air issuing from vents on algific slopes is consistently colder than the 8–10°C reported for caves and springs in temperate latitudes (Poulson and White, 1969; Knudson and Hedges, 1973), indicating the presence of subterranean ice. During the growing season, vegetation and rocks surrounding outflow vents tend to be saturated with water condensed from the mixing of chilled vent air and warmer air above ground (Hayden, 1843; Conard, 1938).

In North America, algific slopes or their functional equivalents have been reported from Indiana (McKnight, 1986), Michigan (Miller and Vitt, 1970), New York (Miller, 1966), West Virginia (Hayden, 1843; Brooks, 1965; Core, 1968, 1975; Kercheval, 1986) and the Driftless Area of Illinois, Iowa, Minnesota and Wisconsin (Conard, 1938, 1952; Frest, 1981, 1983; Lammers, 1983; Roosa, 1984; McKnight, 1985). It is not clear whether taxa reported in other papers (Blagg, 1928; Conard, 1932a, 1932b) occurred on algific slopes, or slopes with only cool northerly exposure.

The algific slopes of the Midwest's Driftless Area have received much attention in recent years because of their relict populations of land snails and rare plants. Foremost among these is the federally-endangered Iowa Pleistocene snail, *Discus macclintocki* (Baker), once known only from ice-age loess deposits and thought

to have been extinct. The rare snails *Vertigo occulta* Leonard and *V. hubrichti* Pilsbry, also relicts from the Pleistocene, inhabit the slopes along with disjunct populations of plants that include *Carex media* R. Br., *Ribes hudsonianum* Richards, *Rhamnus alnifolia* L'Her., *Mitella nuda* L., *Mertensia paniculata* (Ait.) G. Don. and the federally-listed threatened species *Aconitum noveboracense* Gray.

Bryophytes are reportedly abundant on algific slopes in the Driftless Area, but a comprehensive list of species has never been published. We sampled the bryoflora on slopes in Wisconsin to determine if any taxa had disjunct boreal affinities.

METHODS

Bryophytes were collected in May 1987 on four of Wisconsin's largest algific talus slopes, at Chase Creek and Glen Haven, in Grant County, Wisconsin. The slopes, situated on north-facing hillsides, varied in area from about 10 m^2 to 7500 m^2. Vegetation immediately surrounding the slopes was composed of second-growth mesic forest species, primarily sugar maple (*Acer saccharum* Marsh.), basswood (*Tilia americana* L.) and red oak (*Quercus borealis* Michx. f.), along with their attendant understory species.

At the time of our visit, ambient air temperature was 24°C, and temperatures at outflow vents ranged from 2–6°C. Faint jets of fog were visible at the vents, and air turbulence was great enough to stir vegetation immediately surrounding the openings.

Collections were limited to those substrates occurring within the perimeter of the slopes. Nomenclature follows Crum and Anderson (1981), Koponen (1968) and Stotler and Crandall-Stotler (1977). Voucher specimens were deposited at MIL.

RESULTS AND DISCUSSION

Thirty-nine species of bryophytes occurred on the four sites sampled (Table 1). Based on Bowers and Freckmann (1979), *Seligeria donniana* was new to Wisconsin, and *Brachythecium salebrosum, Bryhnia graminicolor, Encalypta procera* and *Mnium stellare* were new to Grant County.

All of the species of bryophytes that we found on algific slopes in Wisconsin occur also in non-algific habitats elsewhere in the four-state Driftless Area (Vitt, 1976; Peck, 1978; McCleary and

Table 1. Bryophytes of four algific talus slopes in Wisconsin. Slope and vent habitats include soil and rocks. Localities: 1 = Chase Creek, 2 = Glen Haven. Habitat: L = log, S = slope, V = cold air vent, * = disturbed soils.

Species	Locality	Habitat
LIVERWORTS		
Conocephalum conicum (L.) Lindb.	1	S*
Marchantia polymorpha L.	1	S*, V
Porella platyphylla (L.) Pfeiff.	1, 2	S, V
Preissia quadrata (Scop.) Nees	2	V
Tritomaria exsecta (Schrad.) Loeske	1	L
MOSSES		
Amblystegium varium (Hedw.) Lindb.	1	S
Anomodon attenuatus (Hedw.) Hueb.	1, 2	S, V
A. rostratus (Hedw.) Schimp.	1	S
Bartramia pomiformis Hedw.	1	S, V
Brachythecium oxycladon (Brid.) Jaeg. & Sauerb.	1, 2	V
B. salebrosum (Web. & Mohr) BSG	1	S
Bryhnia graminicolor (Brid.) Grout	1	V
Bryoerythrophyllum recurvirostrum (Hedw.) Chen	1, 2	V
Bryum capillare Hedw.	1	S*
B. pseudotriquetrum (Hedw.) Gaertn., Meyer & Scherb.	1, 2	S*
Campylium chrysophyllum (Brid.) J. Lange	2	V
Ceratodon purpureus (Hedw.) Brid.	1, 2	S*, V
Climacium americanum Brid.	1	V
Desmatodon obtusifolius (Schwaegr.) Schimp.	1	S*
Didymodon fallax (Hedw.) Zand.	1	S*, V
Encalypta procera Bruch	2	S
Entodon cladorrhizans (Hedw.) C. Muell.	1, 2	L, S
E. seductrix (Hedw.) C. Muell.	1	V
Eurhynchium hians (Hedw.) Sande-Lac.	1	S, V
Funaria hygrometrica Hedw.	1	S*
Leptobryum pyriforme (Hedw.) Wils.	1	S*
Mnium marginatum (With.) Brid. ex P.-Beauv.	2	V
M. stellare Hedw.	1	V
Plagiomnium cuspidatum (Hedw.) T. Kop.	1, 2	L, S, V
P. medium (BSG) T. Kop.	1	S, V
Platygyrium repens (Brid.) BSG	1	L
Pohlia wahlenbergii (Web. & Mohr) Andr.	1	V
Rhodobryum roseum (Hedw.) Limpr.	1, 2	L, V
Rhytidiadelphus triquetrus (Hedw.) Warnst.	1	V
Seligeria campylopoda Kindb. ex Macoun & Kindb.	1	V
S. donniana (Sm.) C. Muell.	1	V
Thuidium abietinum (Hedw.) BSG	2	V
T. delicatulum (Hedw.) BSG	1	S
T. recognitum (Hedw.) Lindb.	2	S

Redfearn, 1979; Horton, 1983). We did not find any species with substantial disjunct distributions, although several such taxa are known to occur on algific slopes in Iowa and Minnesota (D. G. Horton, pers. comm.).

Fourteen (36%) of the bryophytes found on the slopes occurred only at outflow vents, suggesting that the perennially cool and moist conditions found there provide ideal growing conditions. Large polsters of the more typically wetland-inhabiting *Climacium americanum, Marchantia polymorpha* and *Plagiomnium medium,* clustered at vents halfway up the algific slopes, gave the illusion of artesian springs on the hillside, although the only source of water was condensate from the jets of fog occurring at the openings.

The association of bryophytes occurring at cold air vents, coupled with the occurrence of populations of relict snails and rare vascular plants, make algific slopes unique geological and biotic communities. A description of the apparently more diverse bryoflora of algific slopes in Iowa and Minnesota would document the occurrence of disjunct or relic taxa, currently the subject of many recent anecdotal accounts.

T. J. Frest (pers. comm.) estimated that 80% of the slopes that existed in the Driftless Area before European settlement have been destroyed. It is fortunate that The Nature Conservancy and the states of Iowa and Wisconsin are moving to protect the best of those that remain. Global warming will pose new challenges in monitoring these communities.

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